REMARKS

This application has been carefully reviewed in light of the Office Action dated August 10, 2004 (Paper No. 25). Claims 1 to 29, 32 to 60 and 63 to 91 are in the application, of which Claims 1, 32 and 63 are independent. Reconsideration and further examination are respectfully requested.

Claims 1 to 5, 7 to 12, 14 to 19, 21 to 26, 28, 29, 33 to 36, 38 to 43, 45 to 50, 52 to 57, 59, 60, 64 to 67, 69 to 74, 76 to 81, 83 to 88, 90 and 91 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 5,636,338 (Moreton). Reconsideration and withdrawal of this rejection are respectfully requested.

The present invention concerns orientating a space curve defined by digital data corresponding to an image. The space curve has two endpoints and is adapted to have one of two directions, either a forward direction proceeding along the space curve from an initial endpoint to a terminating endpoint or a reverse direction proceeding along the space curve from the terminating endpoint to the initial endpoint. A desired direction to act as a reference for orientating the space curve is selected and a first vector is generated having a direction which is the same as the desired direction. A second vector is generated having a corresponding direction derived from a corresponding characteristic of the space curve. A direction of the space curve is determined based on a comparison of the first and second vectors. The determined direction of the space curve is one of two directions, either the forward or reverse direction, that is closest in direction to the desired direction. The space curve is then oriented to the determined direction.

Turning to specific claim language, amended independent Claim 1 is directed to a method of orientating a space curve defined by digital data corresponding to an image.

The method includes the steps of receiving a predefined space curve, wherein the space curve has two endpoints and is adapted to have one of two directions, either a forward direction proceeding along the space curve from an initial endpoint to a terminating endpoint or a reverse direction proceeding along the space curve from the terminating endpoint to the initial endpoint. The method further includes the steps of selecting a desired direction to act as a reference for orientating the predefined space curve received in said receiving step, generating a first vector having a direction which is the same as the selected desired direction, generating at least one second vector, each second vector having a corresponding direction representative of and derived from a corresponding characteristic of the space curve, comparing the first and second vectors, determining, based on a result of said comparing step, a direction of the space curve, wherein the determined direction of the space curve is one of two directions, either the forward or the reverse direction, that is closest in direction to the selected desired direction, and orientating the direction of the space curve to the determined direction.

In contrast, Moreton describes methods for forming curved shapes for use by a computer. A user provides a specification including a set of geometric constraints, such as positions, tangents, curvatures and torsions. In the preferred embodiment of Moreton, curves are computed so as to locally minimize a scale invariant functional of the geometry of the curve, while satisfying the user defined specification (Abstract). Moreton thus defines a method of computing a curve from a set of constraints, using minimization techniques.

Applicants submit that Moreton addresses an entirely different problem to that addressed by Applicants' method of Claim 1. Claim 1 relates to orientating a predefined space curve rather than computing a new space curve. Thus, there is no need to compute the space curve via minimization procedures, as the space curve is already known. Instead,

Applicants' method of Claim 1 orientates the predefined space curve with reference to a desired direction that acts s a reference for the orientation.

As Moreton computes a space curve, Moreton does not disclose a step of receiving a predefined space curve as in Claim 1. Instead, Moreton receives a specification from a user and then computes a curve that minimizes a functional while satisfying the specification. In the Office Action, it is stated at page 12, that "Moreton discloses receiving a space curve by receiving the specification of the space curve." However, the specification does not uniquely define the curve that results from the minimization computation. The final curve will also depend on other factors such a the choice of the functional that is minimized. Moreton describes different functionals that may be used for minimization, such as a magnitude of variation in curvature of the curve (MCV) or a magnitude of curvature of the curve (MEC). For example, Figs.8A and 8B of Moreton show two curves that result from the same ste of constraints. Minimization in Fig. 8A is obtained using an MEC functional, while the shape of Fig. 8B is formed by an MCV functional for the same set of constraints. Applicants therefore submit that receiving the specification of the space curve is not the same as receiving a predefined space curve as taught in the present application.

Applicants further submit that Moreton does not disclose or suggest selecting a desired direction to act as a reference for orientating the space curve as in Applicants' Claim 1. As defined in the <u>Concise Oxford Dictionary</u> (10th Edition), the verbs "orientate" and "orient" mean to "align or position relative to the points of compass or other specified positions". To orient oneself is to find one's position in relation to unfamiliar surroundings. <u>Webster's New World College Dictionary</u> defines "orientate" as "to face East, or in any specified direction; to adjust to a situation". All of these definitions have in common the

concept of aligning something relative to an external reference. This is reflected in the method of Claim 1 in that the predefined space curve is orientated in accordance with the selected desired direction.

The Office Action asserts, at page 3, that specifying a tangent constraint for a curve is equivalent to selecting the desired direction. However, Applicants submit that the tangent constraint is part of the definition of the curve itself and does not relate to aligning or orientating the curve to an external reference as taught in the present application. If a curve is re-oriented, the curve's tangents are re-orientated accordingly. Furthermore, the tangents of a curve cannot be oriented independently of the curve itself.

The Office Action cites column 8, lines 25 to 45 of Moreton as suggesting the limitation that the space curve is adapted to have one of two directions, either a forward direction proceeding along the space curve from an initial endpoint to a terminating endpoint or a reverse direction proceeding along the space curve from the terminating endpoint to the initial endpoint. Applicants carefully reviewed the cited passage, but can find no reference to a curve having a forward direction along the curve or a reverse direction along the curve.

Moreton is concerned with computation of curve segments to create graphical objects wherein joins between the curve segments are as smooth as possible. To do so, Moreton discloses using quintic Hermite curves sharing geometric specifications at common endpoints. The quintic Hermite curves are specified by the position of the endpoints and the first two parametric derivatives at these locations. $\vec{P}_i'$ is the first parametric derivative of a curve at position p_i. The value of $\vec{P}_i'$ is given by $m_i\hat{t}_i$ where $\hat{t}_i$ is the tangent direction of the curve and m_i is the first derivative of the magnitude. Morton discloses "(d)uring

minimization, the scalar m_i must be constrained to be positive because, if m_i were allowed to become negative, then $\vec{P}_i'$ would reverse direction." This portion of Moreton does not disclose a curve having a forward and reverse direction used in a computation as $\vec{P}_i'$ is simply the first derivative of the curve. Moreton makes it clear that it is the change in sign of m_i that causes the first derivative to change "direction" during a minimization computation and not a change in $\hat{t}_i$ which is the tangent of the curve.

Changing the sign of the first derivative of a curve bears no relation to a forward direction along the curve and a reverse direction along the curve as set out in Claim 1. As an example, consider the equation $y = 2x$. If the sign of the first derivative is reversed, the equation becomes $y = (-2x)$. Although the slope of the line changes, there is nothing to suggest reversing a forward direction from an initial endpoint to a terminating endpoint to obtain a reverse direction proceeding from the terminating endpoint to the initial endpoint.

Even assuming that Moreton's disclosure of a first parametric derivative suggests using a curve having both a forward and reverse direction (which the Applicants do not concede is the case), Moreton teaches away from the use of such a curve for computational purposes. This is because Moreton teaches that to prevent the first parametric derivative from changing in "direction", the first parametric derivative is modified by using m_i^2 instead of m_i as the scaler during the minimization computation. By using m_i^2 instead of m_i, Moreton ensures the first parametric derivative, $\vec{P}_i'$, always has the same sign as the product m_i^2 is always positive.

Applicants further submit that Moreton neither discloses nor suggests the step of "determining, based on a result of said comparing step, a direction of the space curve, wherein the determined direction of the space curve is one of two directions, <u>either the forward or the reverse direction</u>, that is closest in direction to the selected desired direction" (emphasis added). As discussed above, there is no disclosure of such forward and reverse directions by Moreton, and without the impermissible use of hindsight vision afforded by the present invention, there is no disclosure or suggestion of determining a direction of the space curve wherein the determined direction is a binary choice between a forward and a reverse direction.

At page 4, the Office Action cites three passages of Moreton relating to the determining step. The passages are column 8, lines 60 to 65; column 9, lines 3 to 11; and column 11, lines 23 to 25. The same passages were raised in the previous Office Action, and were considered in the Amendment dated May 13, 2004. Applicants have reviewed the cited passages and found nothing in the passages that discloses or suggests a step of "determining, based on a result of said comparing step, a direction of the space curve, wherein the determined direction of the space curve is one of two directions, either the forward or reverse direction, that is closest in direction to the selected desired direction."

The Office Action concedes that Moreton fails to specifically disclose comparing the first and second vectors. However, the Office Action contends that it would have been obvious to one of skill in the art to incorporate comparing the first and second vectors with the disclosure of Moreton "because Moreton discloses the vectors sharing data structures that hold specified parameters, including tangents, for each vector to meet continuity for multiple parameters (col. 8, ll. 50-55, 60-65)". Applicants have reviewed the

cited passages, which relate to a curve made up of a sequence vertices connected by quintic elements. Such disclosure clearly relates to Moreton's methods for forming computer models of curves, networks and surfaces from user-defined specifications of the shape to be modeled. However, Applicants submit that the disclosure is not related to the method of Claim 1, which relates to orientating a predefined space curve relative to a selected desired direction.

Furthermore, Applicants respectfully submit Moreton does not disclose vectors that share data structures, as stated in the Office Action. Instead, Moreton discloses that "adjacent elements share vertex structures" (column 8, line 62). The elements are portions of a curve "made up of a sequence of vertices connected by quintic elements" (column 8, lines 50, 51). Neither the vertices nor the quintic elements are vectors.

In light of the foregoing deficiencies of the prior art, Applicants submit amended Claim 1 is now in condition for allowance and respectfully request same.

Amended independent Claims 32 and 63 are method and product claims, respectively, corresponding to amended independent Claim 1, the foregoing discussion relative to Claim 1 is believed to apply thereto. Accordingly, amended independent Claims 32 and 63 are also believed to be in condition for allowance and Applicants respectfully request same.

The other pending claims in this application are each dependent from the independent claims discussed above and are therefore believed to be in condition for allowance for the same reasons. However, individual consideration of each dependent claim on its own merits is respectfully requested as each dependent claim is also deemed to define an additional aspect of the invention,

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' undersigned attorney may be reached in our Costa Mesa, CA office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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